Montana Greater Sage-grouse Population Report

Submitted by Montana Fish, Wildlife and Park

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Montana Greater Sage-grouse population estimates and associated uncertainty, and the number of known breeding sites (called leks) are presented in this report in compliance with MCA 87-1-201(1)(11), as amended in 2017.

Population Estimates

Montana Fish, Wildlife and Parks (FWP) worked with Dr. Paul Lukacs, University of Montana, to estimate sage-grouse population numbers based on counts of displaying males at leks using *N*-mixture models. Results are presented in Figure 1 and Table 1. This modeling approach is a robust analytical method for estimating population size and trend over time for species like sage-grouse that congregate at discrete breeding sites (McCaffrey et al. 2016). Although FWP maintains a database of male counts at leks that date back to 1952, only data from 2002 onward could be used with this modeling approach. To convert the estimated number of males to a population estimate, we multiplied the estimate by an estimated female to male ratio.

Some Caveats...

All models are an approximation, not truth, and rely on certain assumptions. The assumptions that were made in the development of these population estimates include:

- FWP does not count females but can estimate the number of females based on an assumed sex ratio. We used an average ratio of 2.45:1 females to males based on published literature (Knick and Connelly 2011). While we accounted for the uncertainty in this published ratio in our overall confidence intervals, annual population numbers may be larger or smaller than estimated depending upon the actual ratio in each year.
- Only data from known leks were used in the calculations. This could lead to under-estimating the true population if there were a sizeable number of unknown leks.
- Models assumed each male visited one lek. This could lead to over-estimating the true population if individual males visited and were counted at multiple leks.
- Models assumed each male was detected independently. This could lead to under-estimating the true population if detection of some individuals was dependent upon detection of other individuals.

Sage-grouse population numbers oscillate over a period of 8 – 10 years across large scales (Fedy and Doherty 2011). The lower numbers estimated for Montana's population in the years 2008 – 2014 relative to preceding or subsequent years are likely due, in part, to natural population fluctuations. It is not appropriate to make decisions based on estimates from a single or few years without putting them in the context of a longer timeframe. It is also important to recognize that count data are collected in spring, when population numbers are likely at their lowest. Fall population numbers can be considerably higher in years with good reproduction.

There are other analytical models that have utility for estimating population size and trends, such as Integrated Population Models. However, these models require additional demographic information, such as recruitment data, that are currently unavailable statewide. FWP may explore additional modeling techniques in the future as new data become available.

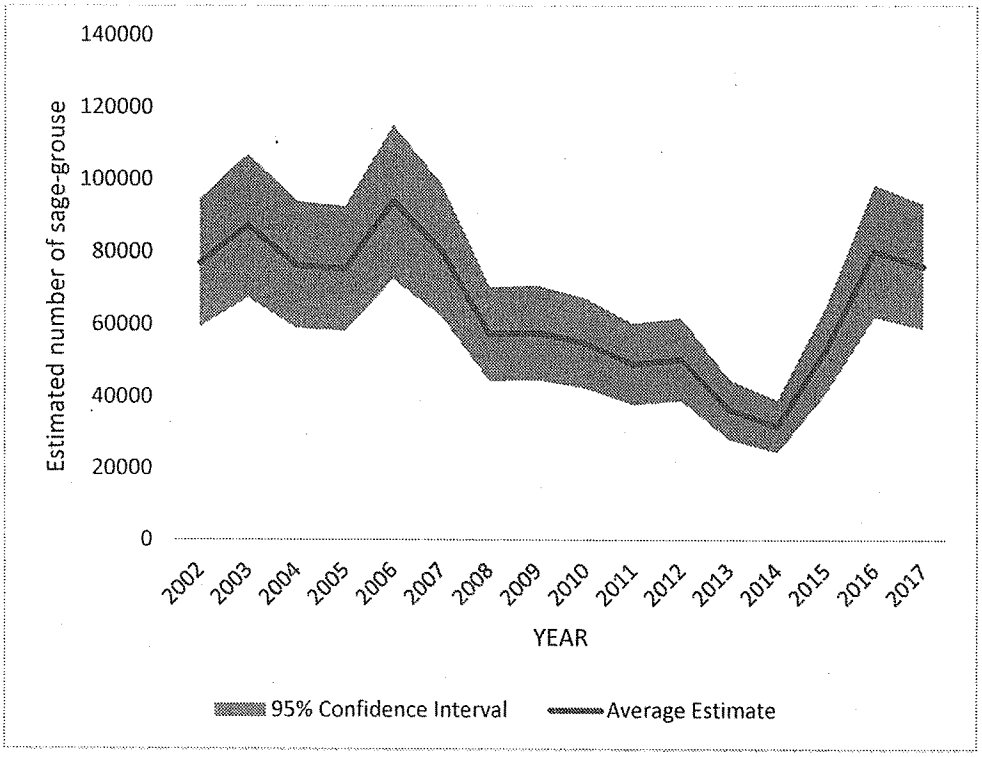


Figure 1. Graphical representation of Greater Sage-grouse population estimates in Montana, 2002 – 2017. In general terms, confidence intervals are the range of values that describe the uncertainty associated with the population estimate.

Table 1. Numerical estimates of sage-grouse numbers and associated uncertainty from *N*-mixture models in Montana, 2002-2017.

Year	Population Estimate	Standard Error	95% Confidence Interval	
			Lower Bound	*Upper Bound*
2002	76989	9005	59339	94639
2003	87303	10117	67474	107132
2004	76362	8890	58938	93786
2005	75352	8707	58286	92418
2006	93909	10866	72612	115206
2007	80600	9291	62390	98810
2008	57423	6647	44395	70451
2009	57749	6682	44652	70846
2010	54873	6341	42445	67301
2011	49086	5720	37875	60297
2012	50490	5863	38999	61981
2013	36400	4217	28135	44665
2014	31757	3696	24513	39001
2015	53116	6138	41086	65146
2016	80245	9276	62064	98426
2017	75979	8775	58780	93178

Number of Leks

FWP maintains a spatial database of Greater Sage-grouse leks, summarized by activity status in Table 2. FWP staff are continually working to confirm and record new lek locations and update status. The number of known confirmed active leks in 2017 is almost double the number in 2002, in large part because of increased survey effort by FWP staff.

Table 2. Number of known Greater Sage-grouse leks in Montana by activity status, 2002 – 2017.

Year	Confirmed Active	Confirmed Inactive	Confirmed Extirpated	Never Confirmed Active	Unconfirmed	Total
2002	550	79	17	29	512	1187
2003	615	84	17	47	519	1282
2004	651	88	19	56	531	1345
2005	676	94	19	64	543	1396
2006	719	96	19	67	604	1505
2007	754	98	20	72	630	1574
2008	811	100	22	75	590	1598
2009	852	104	25	91	552	1624
2010	947	110	40	118	447	1662
2011	970	125	50	151	383	1679
2012	979	133	50	181	352	1695
2013	980	144	59	201	329	1713
2014	984	155	65	233	285	1722
2015	986	174	65	251	257	1733
2016	990	188	66	264	255	1763
2017	1001	203	66	261	265	1796

Status Definitions:

Confirmed Active - Data supports existence of lek. Supporting data defined as 1 year with 2 or more males lekking on site followed by evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) within 10 years of that observation.

Confirmed Inactive - A Confirmed Active lek with no evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) for the last 10 years. Requires a minimum of 3 survey years with no evidence of lekking during a 10-year period. Reinstating Confirmed Active status requires meeting the supporting data requirements.

Confirmed Extirpated - Habitat changes have caused birds to permanently abandon a lek (e.g., plowing, urban development, overhead power line) as determined by the biologists monitoring the lek.

Never confirmed active – An Unconfirmed (UC) lek that was never confirmed active. Requires 3 or more survey years with no evidence of lekking (Birds - male, female or unclassified; -OR- Sign - vegetation trampling, feathers, or droppings) over any period of time.

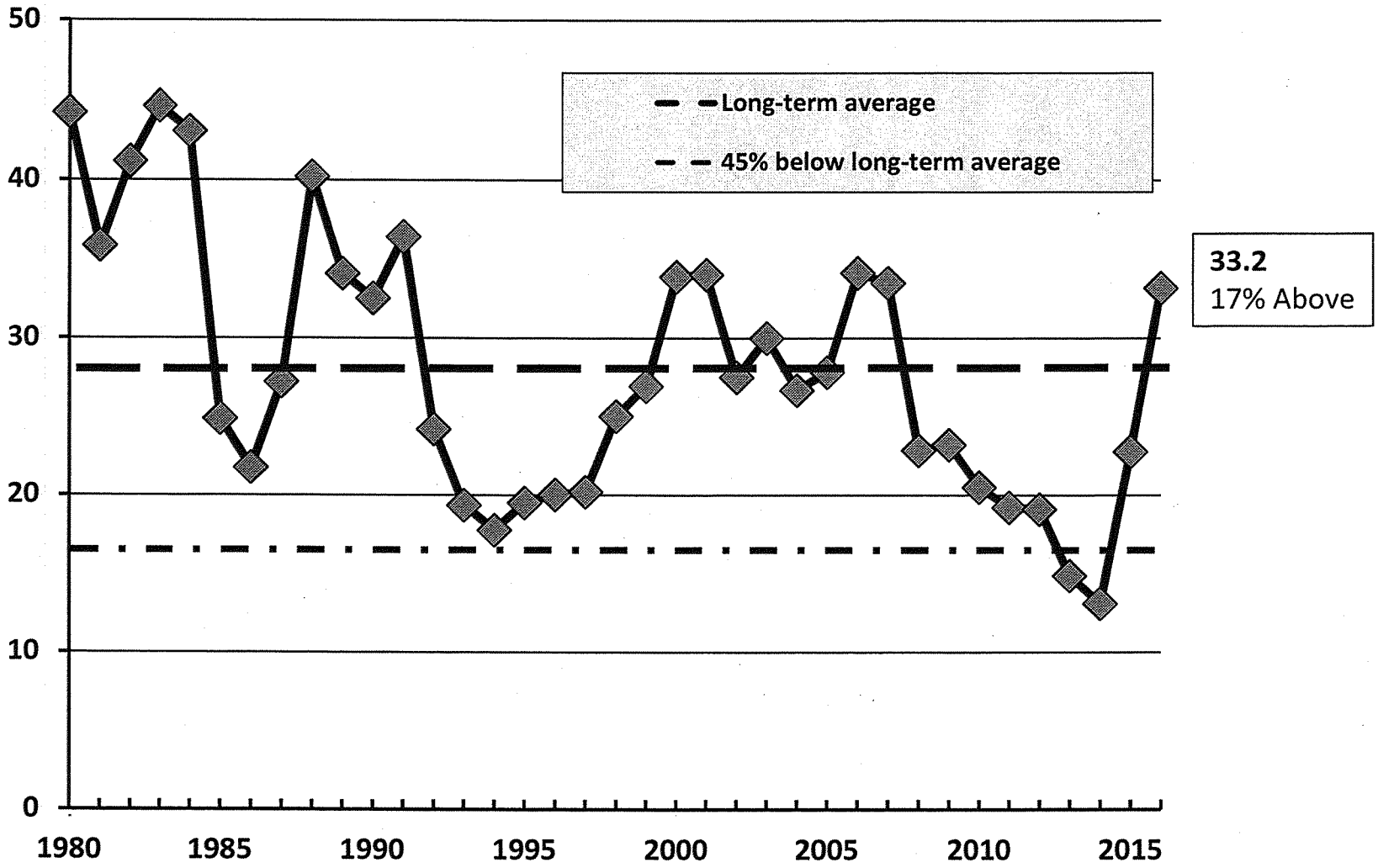
Unconfirmed - Possible lek. Grouse activity documented. Data insufficient to classify as Confirmed Active status.

References

McCaffrey, R., J.J. Nowak, and P.M. Lukacs. 2016. Improved analysis of lek count data using N-Mixture models. Journal of Wildlife Management; DOI: 10.1002/jwmg.21094.

Knick, S.T. and J.W. Connelly, eds. 2011. Greater Sage-grouse: Ecology and conservation of a landscape species and its habitats. Studies in Avian Biology, University of California Press, Berkeley, CA.

Fedy, B.C. and K.E. Doherty. 2010. Population cycles are highly correlated over long time series and large spatial scales in two unrelated species: greater sage-grouse and cottontail rabbits. Oecologia; DOI 10.1007/s00442-010-1768-0



Average number of male sage-grouse counted on Montana AHM leks, 1980-2016.